

Claims

What is claimed is:

1. A method for controlling hydraulic flow through a valve, comprising:
determining a pressure drop across the valve;
estimating a flow rate through the valve based on the pressure drop and a displacement of the valve; and
computing a command signal to actuate the valve based on a desired flow rate and the estimated flow rate through the valve.
2. The method of claim 1, wherein the flow rate through the valve is estimated by a spool map.
3. The method of claim 1, wherein the command signal is computed by a closed-loop system.
4. The method of claim 1, further including compensating a difference between the desired flow rate and the estimated flow rate to determine the command signal to actuate the valve.
5. The method of claim 1, wherein the pressure drop across the valve is determined by monitoring an inlet port pressure and an outlet port pressure of the valve.
6. The method of claim 5, wherein the monitored inlet port pressure and outlet port pressure are converted into an inlet port pressure signal and an outlet port pressure signal, and the inlet port pressure signal and the outlet port pressure signal are subjected to a noise filter for stabilization.

7. The method of claim 1, wherein the displacement of the valve is estimated based on a command signal provided to the valve.

8. The method of claim 1, wherein the displacement of the valve is measured by a valve position sensor.

9. The method of claim 1, further including determining a dead band offset of the valve and wherein the valve is actuated based on the desired flow rate and the estimated flow rate through the valve and the offset of the valve.

10. A system for controlling hydraulic flow through a valve, the valve having an inlet port and an outlet port and being coupled to an actuator for actuating the valve, the system comprising:

a pressure sensor assembly configured to monitor a pressure drop across the valve; and

a flow controller coupled to the pressure sensor assembly, the flow controller being configured to estimate a flow rate through the valve based on the pressure drop and a displacement of the valve, and to determine a command signal to the actuator based on the estimated flow rate and a desired flow rate through the valve.

11. The system of claim 10, wherein the flow controller includes a memory unit for storing a spool map to estimate the flow rate.

12. The system of claim 10, wherein the command signal to the actuator is configured to be determined by a closed-loop system.

13. The system of claim 10, wherein the flow controller includes a compensator for compensating a difference between the desired flow rate and the estimated flow rate to determine the command signal to the actuator.

14. The system of claim 10, wherein the pressure sensor assembly includes first and second pressure sensors for monitoring pressure at the inlet and outlet ports of the valve, respectively, the flow controller being coupled to the first and second pressure sensors for monitoring a pressure drop across the valve.

15. The system of claim 14, wherein the flow controller includes a noise filter to stabilize the monitored pressure signals at the inlet port and the outlet port of the valve.

16. The system of claim 10, wherein the flow controller includes a memory unit for storing an actuator map to estimate the displacement of the valve based on the command signal provided to the actuator.

17. The system of claim 10, further including a valve position sensor coupled to the controller for sensing the displacement of the valve.

18. The system of claim 10, wherein the flow controller includes an offset logic unit for determining a dead band offset of the valve.

19. The system of claim 18, wherein the command signal is determined based on the desired flow rate and estimated flow rate through the valve, and the dead band offset of the valve.

20. A machine for moving a load, comprising:
a pump;
a hydraulic actuator in fluid communication with the pump;
an independent metering valve in fluid communication with the pump and the hydraulic actuator; and
a hydraulic flow control system coupled to the independent metering valve for controlling a hydraulic flow through the valve, the system including:

a pressure sensor assembly configured to monitor a pressure drop across the valve; and

a flow controller coupled to the pressure sensor assembly, the flow controller being configured to estimate a flow rate through the valve based on the pressure drop and a displacement of the valve, and to determine a command signal to the actuator based on the estimated flow rate and a desired flow rate through the valve.